5.1 Thermal physics

This section provides knowledge and understanding of temperature, matter, specific heat capacity and specific latent heat with contexts involving heat transfer and change of phase (HSW1, 2, 5, 7).

Experimental work can be carried out to safely investigate specific heat capacity of materials (HSW4).

It also provides an opportunity to discuss how Newton's laws can be used to model the behaviour of gases (HSW1) and significant opportunities for the analysis and interpretation of data (HSW5).

5.1.1 Temperature

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	thermal equilibrium	
(b)	absolute scale of temperature (i.e. the thermodynamic scale) that does not depend on property of any particular substance	HSW7
(c)	temperature measurements both in degrees Celsius (°C) and in kelvin (K)	HSW7
(d)	$T(K) \approx \theta(°C) + 273$.	

(6) M - Convert between Celsius and Kelvin
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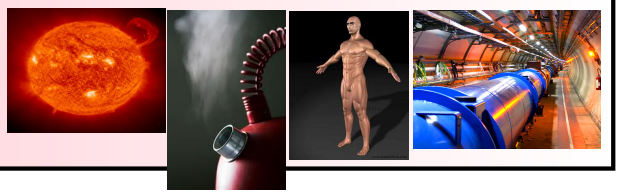
Lesson 1 Temperature

STARTER: What is the **difference** between heat and temperature?

Check you checklist - What are you familiar with from GCSE?

Extension:



- **Heat** is a type of energy that flows because of a temperature gradient. (unit joules)
- **Temperature** is a measure related to the mean KE of the particles of a substance. And determines the direction heat flow (unit K or another scale)

Activities:

1. Get checklist. Check for prior understanding (one color highlight)
2. get definisions (HWK)
3. get hwk
4. multiple choice quiz set

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Absolute temperature

http://www.independent.co.uk/life-style/gadgets-and-tech/news/nasa-scientists-coldest-place-international-space-station-spacex-coolest-freezing-a7619191.htr

What is an absolute scale?

An **absolute scale** always starts at a minimum value and progresses in one direction from there.

① Temp / k ② Mass ③ Length.

Can you think of any absolute scale? why are they absolute?

OK −273°C

The lowest possible temperature is called absolute zero**. At this temperature the particles have zero KE, a**nd **minimum** internal energy. The absolute temperature scale does not depend on the properties of a particular substance.

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In order to measure temperature a scale is needed that has two fixed reference points at defined temperatures.

1. Describe how the Celsius scale works.
2. Describe the original problem with the Celsius scale?
3. Describe the absolute temperature scale, and state the unit.
4. The absolute temperature scale relies on the triple point of water being constant. What is the triple point of water? (meaning)

Absolute temperature

- It has two fixed points: Absolute zero (0K)
- Triple point of water (273.16K); where water, ice and water vapour can co-exist.

0K = -273.15 °C
0°C = 273.15 K

Ex:What is the triple point of water in Celsius?

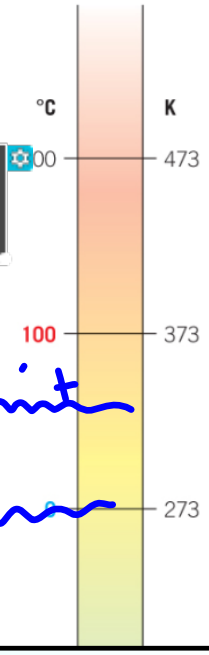
T (K) = θ (°C) +273

1. Convert these temperatures into Kelvin:
(a) 100°C (b) 0°C (c) 56°C (d) – 120°C
373 273 329 153

2. Convert these temperatures into °C:
(a) 0K (b) 100K (c) 250K (d) 300K
-273 -173 -23 27

good estimate for room temp

Ex: When is using the kelvin scale (not celcius) a) most important b) least important?



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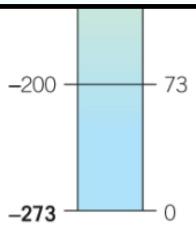
Activity: summary questions p270



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Thermal Equilibrium

Thermal energy is transferred from regions of higher temperatures to regions of lower temperatures, until the two regions have the same temperature. This is known as thermal equilibrium - **No net transfer of thermal energy between objects**

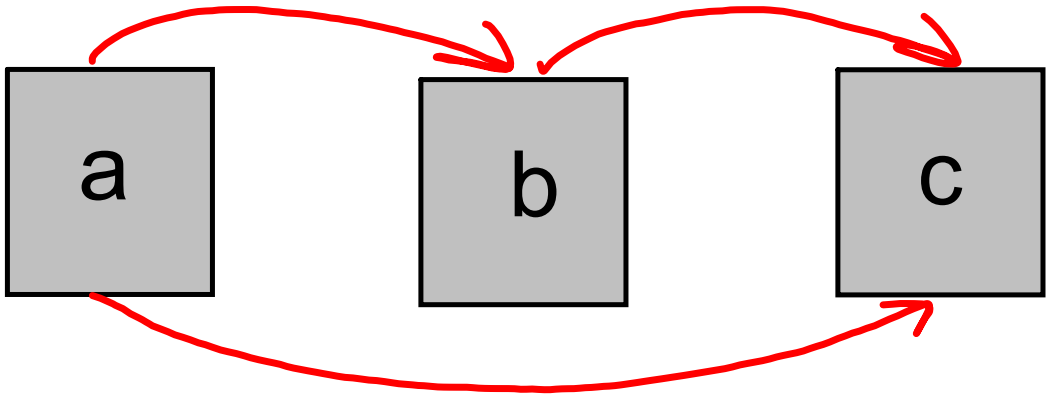
'If two objects are each in thermal equilibrium with a third, then all three are in thermal equilibrium with each other.'

Thermal equilibrium demo (water)

Sketch the setup,

1. Describe the term thermal equilibrium in terms of transfer of energy in this setup
2. Explain what the demo should show over a period of time.
3. State the **Zeroth law of thermodynamics. How does this abbly to the setup?**
4. **Scetch the graph of time v temp for both bodies.**

Ex: predict how long to reach thermal equilibrium. What factors affect it?



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Mini plenary - explain why when you put eggs in the fridge after a time they are in thermal equilibrium with the peanut butter....

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Activity: summary questions p270

Plenary

2 Convert the following temperatures from °C into K:
a 0°C **b** 37.0°C **c** −120.5°C. *(3 marks)*

3 Convert the following temperatures from K into °C:
a 0 K **b** 200 K **c** 350 K. *(3 marks)*

Ex: When is using the correct scale a) most important b) least important?